

Southern Company's Demonstration of a 285 MW Coal-Based Transport Gasifier Project

Benefits Presentation



Clean Coal Power Initiative - Round 2 -

Demonstration of Air-blown
Integrated Gasification
Combined Cycle (IGCC) Power
Plant With Coal-based Transport
Gasifier

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Outline

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Outline (continued)

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Executive Summary

- **Southern Company Services, Inc., will design, construct, and operate a coal-based transport gasifier as part of an air-blown IGCC power plant under CCPI, Round 2**
- **The design will be fuel-flexible, higher efficiency, and lower capital and operating costs than currently available**
- **The process will be less costly to operate due to the use of O₂ in the air, which does not require costly separation of O₂ from the air as in oxygen-blown gasifiers**
- **Economics are preserved when incorporating CO₂ capture and sequestration into the design**



Project Information

Plant, Fuel, Location, Cost, and Schedule

- Design, construction and operation of a full-scale demonstration of a highly efficient, fuel-flexible, coal-based, air-blown transport gasifier in an IGCC power plant
- 3,300 tons of sub-bituminous coal per day producing 285 MW of electricity
- Location: Stanton Energy Center, Orange County, FL
- Project Cost: \$557 million (DOE share: \$235 million)
- Schedule:
 - 2006 Project Start
 - 2007 to 2009 Construction
 - 2010 to 2014 Operation



Project Information (continued)

Team Members

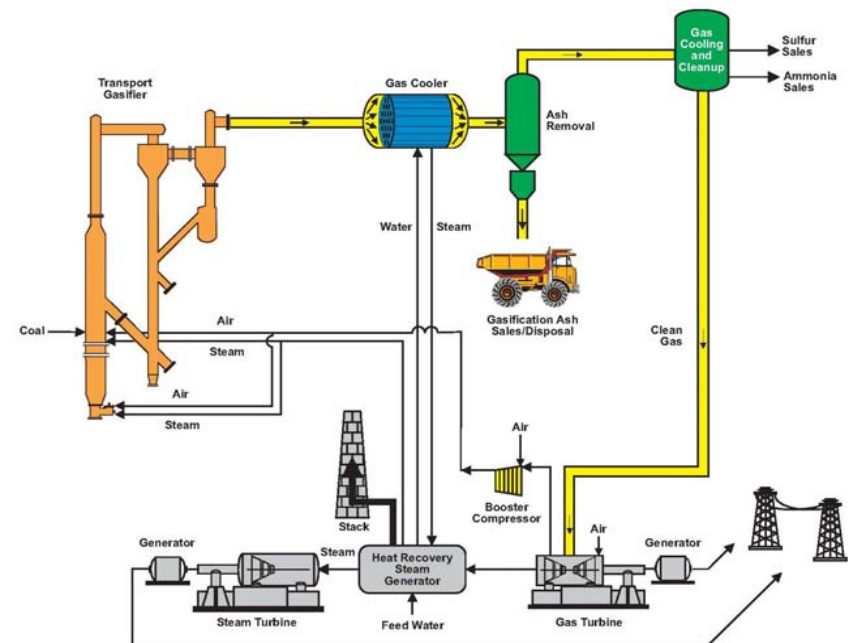
- **Southern Company Services, Inc. (Birmingham, AL)**
 - Project & technology management
- **Southern Power Company Orlando Gasification, LLC (Birmingham, AL)**
 - Co-owner
- **Orlando Utilities Commission (Orlando, FL)**
 - Co-owner
- **Kellogg Brown and Root (Houston, TX)**
 - Technology partner



Project Information (continued)

IGCC System Basics

- **IGCC plants use power cycles, generating electricity more efficiently**
 - Coal is heated in a specialized process to release syngas which is used to generate electricity in a turbine
 - Then exhaust gas from the turbine is used to heat water, which produces steam to generate additional electricity
- **With two power cycles, the amount of electricity generated from a ton of coal is increased**



Project Information (continued)

Oxygen (O_2) versus Air-blown IGCC Systems

- **Coal gas is produced with O_2 in some IGCC plants**
- **O_2 plants:**
 - Are expensive to build
 - Require high levels of electricity to operate
 - Reduce electricity available for sale to consumers
- **Southern Company's air-blown IGCC system uses O_2 from the air to produce syngas, increasing the overall efficiency of the plant**
 - Process does not require a costly O_2 plant



Project Information (continued)

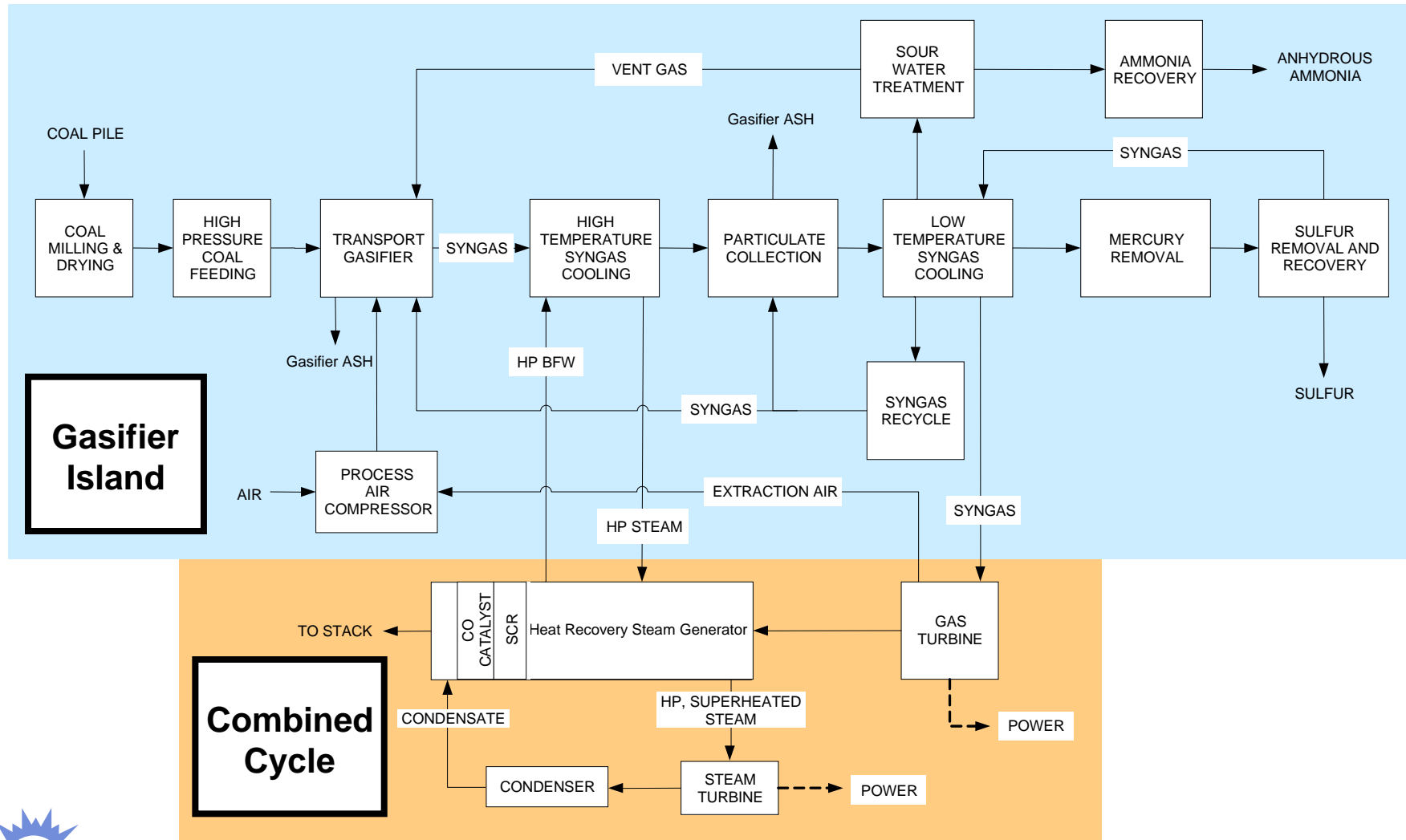
Transport Gasifiers

- **FE sponsored research on the transport gasifier at the Wilsonville Process Development Facility is:**
 - Fuel-flexible
 - Unique because it can cost-effectively process low rank coals and coals with high moisture or high ash content
 - Adaptable to other applications beyond power generation, such as chemical production
 - Efficient (40.6%), operating at a heat rate of 8,400 Btu/kWh



Project Information (continued)

IGCC Summary Flow Diagram



Estimated Benefits

Approach

- Compare the IGCC Plant emission performance against standards for Clean Coal Technology Roadmap plant in 2020
- Compare scaled-up 500 MW transport gasifier plant (more efficient than demonstration plant) to emission rates and capital and operating costs to those of other coal-based technologies of equal size



Estimated Benefits (continued)

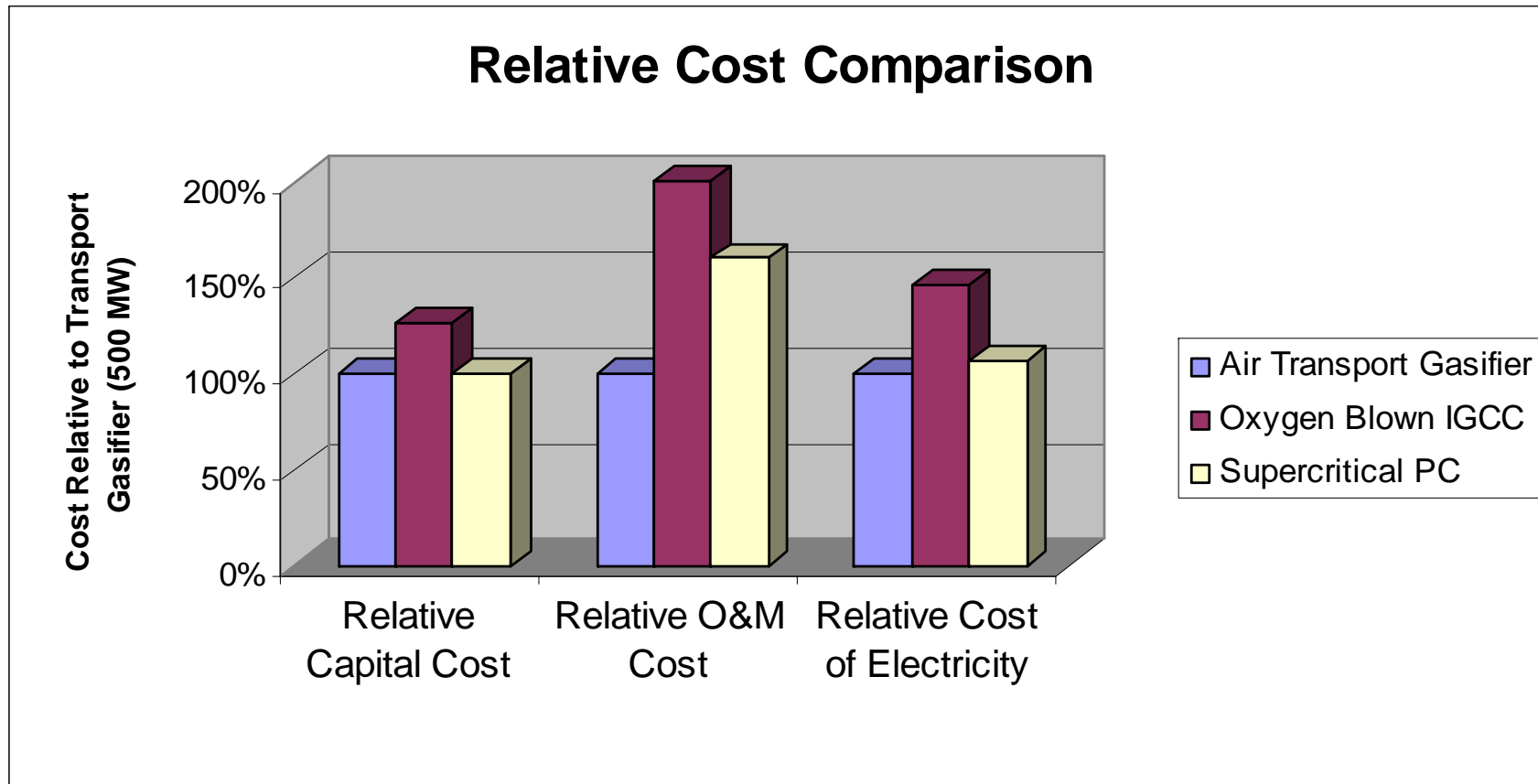
Comparison Assumptions

- **Benefits comparisons are based on the following plant configurations for a sub-bituminous coal:**
 - Oxygen-blown IGCC plant based on two gasifiers, two GE 7FA gas turbines, full heat recovery, methyldiethanolamine (MDEA) sulfur removal and 1,615 psia /1,000°F/1,000°F steam conditions
 - Supercritical Pulverized Coal (PC) plant with Selective Catalytic Reduction (SCR) & Spray Dryer Absorption (SDA) 97% sulfur capture and 3,515 psia/1,050°F/1,050°F steam conditions
 - Transport gasifier plant based on two gasifiers, two GE 7FA gas turbines, CrystaSulf™ sulfur removal and 1,815 psia/1,000°F/1,000°F steam conditions



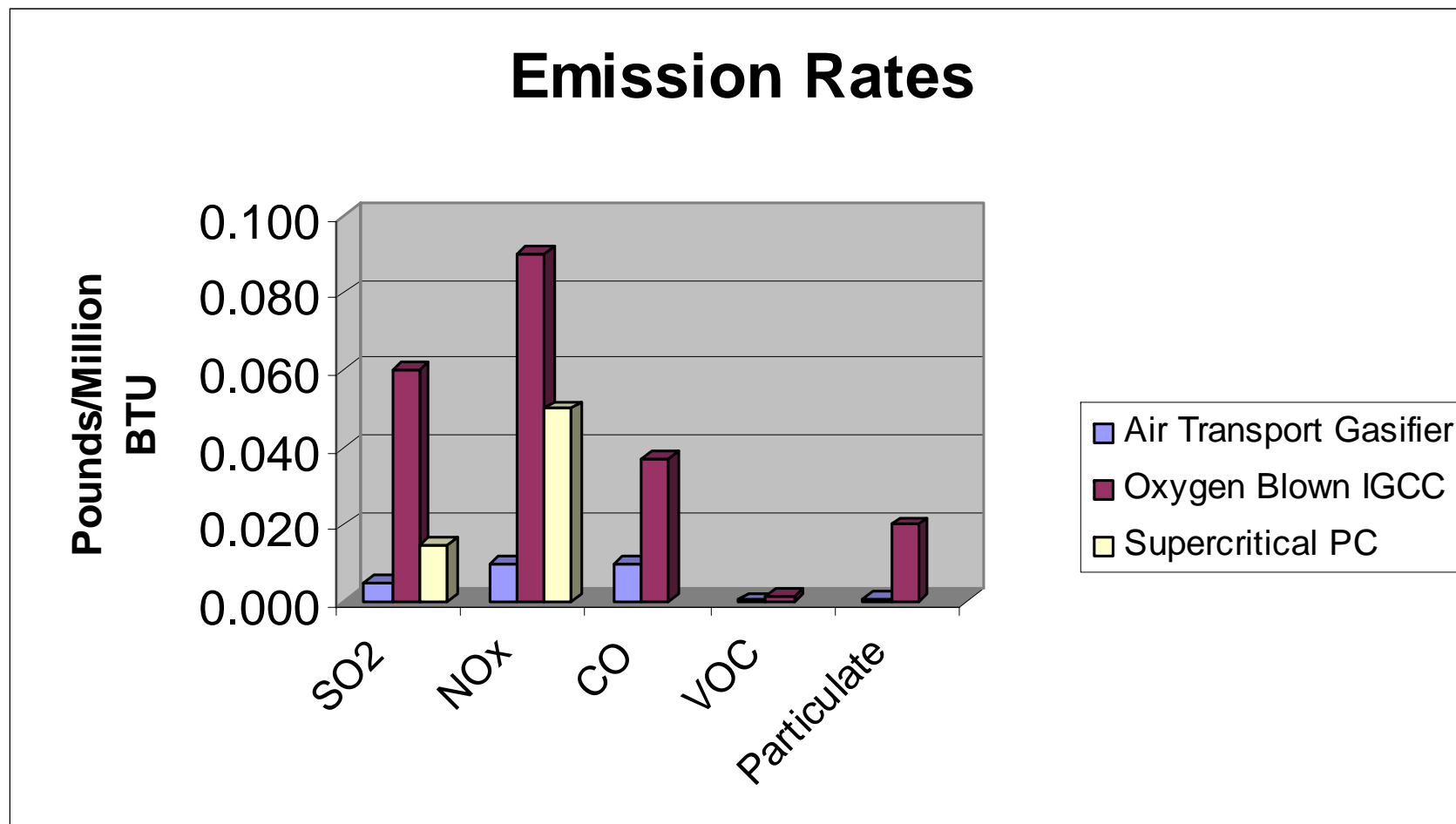
Estimated Benefits (continued)

Financial



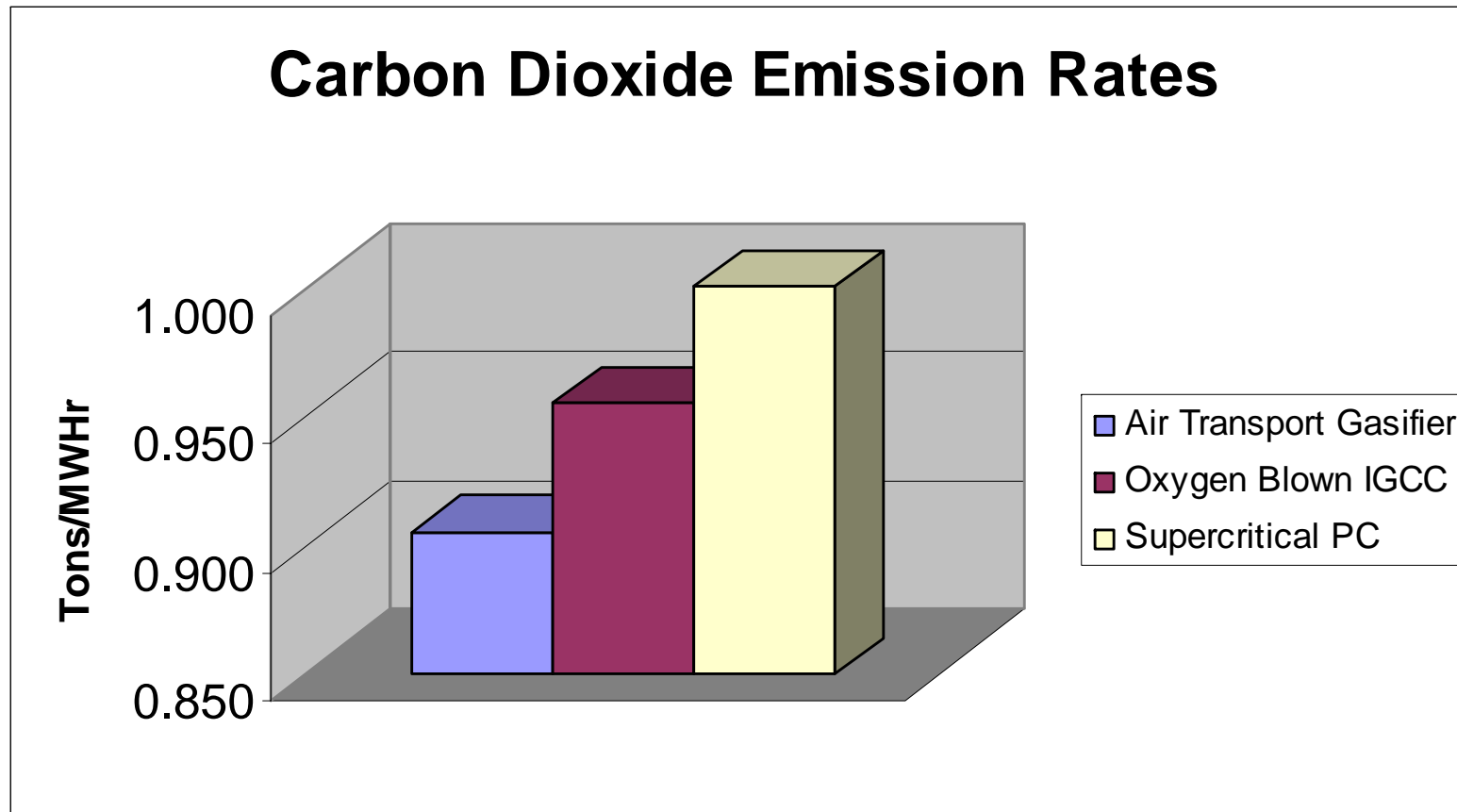
Estimated Benefits (continued)

Emissions



Estimated Benefits (continued)

CO₂ Emissions



Estimated Benefits (continued)

Reliability and Availability

- **Reduced number and duration of outages due to lower operating temperature extending refractory and component life**
- **Less maintenance on ash removal system than in more complex oxygen-blown systems**
- **Air-blown capability avoids O₂ plant maintenance issues**
- **Transport gasifier requires no burners**



Estimated Benefits (continued)

Combustion Utilization By-product

- **All recovered sulfur marketable locally**
- **Gasifier ash tested and designated non-hazardous**
 - Potential applications identified
 - Remaining ash can be land filled on-site
- **Anhydrous ammonia recovered from process water**
 - Utilized in demonstration SCR unit
 - Remainder consumed by units at the Stanton Energy Center or sold



Estimated Benefits (continued)

Regional

- Plant construction will create an estimated 1,800 jobs in Orange County, FL
- Reduced water consumption is incorporated into plant design
- On-site research projects, in partnership with the Florida Energy Office, can potentially expand the use of “next generation” hydrogen technology for fuel cells or vehicles



Estimated Benefits (continued)

National

- **Air-blown systems will be:**

- one of the cleanest, simplest, and most robust methods for generating power from coal
- more energy and cost efficient than currently available oxygen-blown entrained-flow gasifiers
- fuel flexible, processing low rank coals and coals with high moisture or high ash content (half the proven reserves in U.S.)
- able to meet high environmental standards for SO₂, NO_x, particulate, and mercury emissions
- adaptable to other applications, such as chemical production
- adaptable for carbon capture and sequestration technologies



Estimated Benefits (continued)

National

- **Beneficial uses for gasifier ash have been identified**
- **The technology increases energy security by utilizing the Nation's sub-bituminous coal reserves**
- **Furthers environmental initiatives for America:**
 - Clear Skies
 - Global Climate Change
 - FutureGen
 - Hydrogen



Conclusions

- The transport gasifier is very flexible, offering numerous regional as well as national benefits
- The gasifier will readily adapt to possible future requirements
 - Greenhouse gas management
 - Economic benefits are preserved when CO₂ capture and sequestration is incorporated into the design



**Visit the NETL web site for information on all
Power Plant Improvement Initiatives and
Clean Coal Power Initiative projects**

www.netl.doe.gov/technologies/coalpower/cctc

